

II. ENERGY MANAGEMENT IN BUILDINGS AND FACILITIES

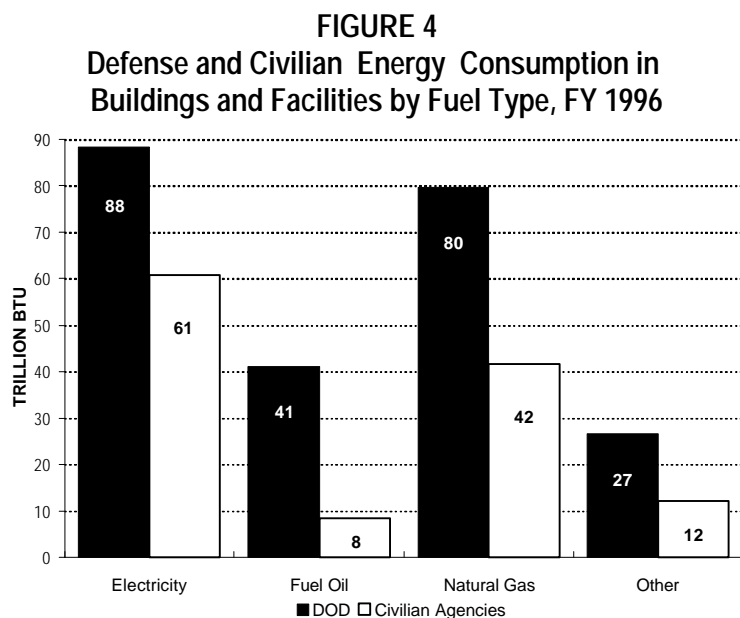
A. Energy Consumption and Costs for Buildings and Facilities

The Federal Government provides energy to approximately 500,000 buildings and facilities comprising approximately 3.0 billion square feet of floor area. This energy is used to provide lighting, heating, ventilation, air conditioning, and other standard building services, as well as a significant amount of process operations that are not reported separately.¹¹ Both the magnitude of energy consumption and the potential for energy savings have prompted legislative and executive branch initiatives to achieve energy conservation in the Federal buildings sector.¹² Section II(B) describes major legislative requirements and highlights agency progress in meeting goals. Section V of this report discusses individual agency efforts in greater detail.

Table 4-A shows the total gross energy consumed in Federal buildings and facilities, including energy resources used to generate, process, and transport electricity and steam.¹³ Gross energy consumed in buildings and facilities in FY 1996 decreased 12.0 percent from FY 1985 and 1.8 percent from FY 1995.

Table 4-B shows that agencies have decreased net energy consumption in buildings by 24.0 percent, from 471.6 trillion Btu in FY 1985 to 358.5 trillion Btu in FY 1996. A comparison to FY 1995 shows a decrease of 2.2 percent in total buildings energy consumption.

Of the 28 agencies represented on the tables for FY 1996, 11, including DOD, consume over 98 percent of the reported buildings energy use. Energy used in buildings accounts for approximately 32.4 percent of the total 1.11 quads used by the Federal Government. The mix of Federal buildings energy use for Defense and civilian agencies is depicted in Figure 4. Electricity constitutes 41.6 percent (149.2 trillion Btu) of Federal buildings energy use; 33.8 percent is accounted for by natural gas (121.3 trillion Btu), and 13.8 percent by fuel oil



¹¹Process energy is that energy used in buildings for operations other than standard building services. In cases where separate reporting was not possible, due to the lack of meters or estimation techniques, process energy was reported as though it was part of the energy used for standard building services.

¹²The legislative authorities for Federal agencies are detailed in Appendix A.

¹³Source conversion factors of 11,600 Btu per kilowatt hour for electricity and 1,390 Btu per pound of steam are used to calculate gross energy consumption. See Appendix B for conversion factors for net energy consumption.

TABLE 4-A
FEDERAL GROSS ENERGY CONSUMPTION IN BUILDINGS AND FACILITIES
(In Billions of Btu, with Conversions to Millions of Barrels of Oil Equivalent [MBOE], and Petajoules [Joule x 10¹⁵])

CIVILIAN AGENCY	FY 1985	FY 1986	FY 1987	FY 1988	FY 1989	FY 1990	FY 1991	FY 1992	FY 1993	FY 1994	FY 1995	FY 1996	%Change 85-96	%Change 95-96
USPS	39,441.0	39,869.0	41,604.2	43,801.4	45,783.8	46,961.6	48,347.0	50,147.1	54,073.7	55,445.6	56,551.3	58,757.3	49.0	3.9
DOE	57,430.1	55,887.9	55,086.1	56,902.3	54,218.3	54,839.0	52,941.5	56,282.4	57,050.7	55,100.0	53,654.4	53,930.0	-6.1	0.5
VA	42,333.7	41,539.9	41,703.6	44,208.4	44,638.1	43,818.9	44,954.2	44,759.7	45,620.4	46,265.4	46,823.0	48,062.3	13.5	2.6
GSA	41,207.0	33,948.9	32,264.2	30,314.2	30,916.4	35,985.0	34,685.4	34,300.3	34,198.2	33,661.4	32,912.4	34,286.0	-16.8	4.2
DOJ	8,962.7	9,539.8	9,290.5	11,160.0	9,929.5	9,376.1	12,038.8	9,285.9	11,999.4	11,390.0	11,836.6	14,391.8	60.6	21.6
HHS	12,605.4	10,322.4	10,869.2	11,930.4	12,676.1	16,191.3	14,353.7	15,857.0	16,086.8	16,320.7	11,904.8	12,623.5	0.1	6.0
DOT	8,298.7	8,694.0	7,377.3	7,315.5	6,692.7	7,114.8	6,609.9	8,355.1	8,687.6	8,427.4	9,020.4	9,097.4	9.6	0.9
NASA	6,373.5	6,710.6	6,875.1	6,995.9	7,305.3	7,363.2	7,388.3	7,151.6	7,056.1	7,299.4	7,848.1	8,571.6	34.5	9.2
DOI	8,432.5	6,849.9	6,692.3	7,366.5	7,745.0	7,511.8	7,746.9	6,824.4	8,320.8	8,186.2	7,646.7	6,177.5	-26.7	-19.2
USDA	4,347.2	4,210.0	4,734.5	4,366.4	4,399.9	5,397.9	5,604.9	5,339.6	5,477.6	5,253.7	5,118.6	5,280.2	21.5	3.2
DOL	3,687.8	3,751.7	3,785.1	3,914.9	3,880.5	3,864.3	3,784.8	3,821.2	3,955.1	4,033.6	3,922.1	4,043.4	9.6	3.1
TRSY	1,451.0	1,423.9	3,488.5	6,691.5	5,656.9	5,004.1	4,372.2	4,805.4	4,250.4	4,351.0	3,752.5	3,607.0	148.6	-3.9
TVA	1,321.0	1,526.2	1,551.2	1,500.1	1,383.8	1,410.5	1,423.4	1,422.0	1,465.1	2,228.3	2,465.3	2,387.9	80.8	-3.1
EPA	1,618.3	1,539.7	1,465.9	1,565.4	1,558.7	1,616.4	1,782.6	1,811.6	1,898.2	1,984.3	2,131.8	2,096.3	29.5	-1.7
DOC	1,189.1	2,571.4	2,485.7	2,683.6	3,062.9	3,227.4	3,220.7	1,483.1	1,664.7	2,047.3	1,361.7	1,313.7	10.5	-3.5
ST	689.2	724.5	803.1	781.1	796.4	817.3	845.4	829.4	133.4	235.6	255.3	780.5	13.3	205.7
FEMA	190.5	295.6	312.1	351.8	395.3	459.6	442.7	453.6	421.5	410.3	410.3	410.3	115.3	0.0
HUD	349.3	350.1	355.7	373.0	417.0	426.5	413.4	384.4	350.3	324.2	316.6	332.9	-4.7	5.1
OPM	168.1	174.6	175.1	200.6	214.0	218.2	227.1	226.6	237.1	237.1	237.1	237.1	41.1	0.0
PCC	90.5	90.8	92.4	96.6	95.8	97.2	110.2	102.3	110.5	106.8	108.6	110.3	21.8	1.6
FCC	29.5	31.9	34.5	35.2	32.4	41.0	43.7	33.9	35.1	39.4	39.4	31.7	7.2	-19.6
OTHER*	588.9	786.9	939.0	997.3	1,147.8	1,070.0	611.3	593.5	376.6	375.9	2,406.9	4,379.2	643.6	81.9
CIVILIAN AGENCIES TOTAL														
BBTU	240,805.2	230,839.8	231,985.4	243,552.1	242,946.3	252,812.0	251,948.1	254,270.0	263,469.4	263,723.5	260,724.0	270,907.9	12.5	3.9
DOD	581,170.2	552,598.8	595,765.7	546,127.6	576,994.6	580,184.6	523,370.8	524,164.8	523,295.3	502,215.0	476,188.2	452,388.4	-22.2	-5.0
ALL AGENCIES TOTAL														
BBTU	821,975.4	783,438.6	827,751.1	789,679.6	819,941.0	832,996.6	775,318.9	778,434.7	786,764.7	765,938.5	736,912.2	723,296.4	-12.0	-1.8
MBOE	141.1	134.5	142.1	135.6	140.8	143.0	133.1	133.6	135.1	131.5	126.5	124.2		
Petajoules	867.2	826.5	873.2	833.1	865.0	878.8	817.9	821.2	830.0	808.0	777.4	763.1		

DATA AS OF 12/05/97

*Other includes for certain years the CFTC, CIA, EEOC, FTC, NARA, NSF, NRC, RRB, SSA, USIA, and FERC.

Note: FY 1996 contains estimated data for the following agencies: FEMA, FTC, and OPM. This table uses a conversion factor for electricity of 11,600 Btu per kilowatt hour and 1,390 Btu per pound of steam. Agencies are listed in descending order of consumption for the current year. Sum of components may not equal total due to independent rounding.

Source: Federal Agency Annual Energy Management Data Reports

TABLE 4-B
FEDERAL NET ENERGY CONSUMPTION IN BUILDINGS AND FACILITIES
(In Billions of Btu, with Conversions to Millions of Barrels of Oil Equivalent [MBOE], and Petajoules [Joule x 10¹⁵])

CIVILIAN AGENCY	FY 1985	FY 1986	FY 1987	FY 1988	FY 1989	FY 1990	FY 1991	FY 1992	FY 1993	FY 1994	FY 1995	FY 1996	%Change 85-96	%Change 95-96
VA	24,552.0	24,425.3	24,217.5	25,625.0	25,619.9	24,380.1	24,733.0	24,620.0	25,077.2	25,213.4	25,075.4	26,172.3	6.6	4.4
DOE	32,923.2	32,077.9	30,890.4	31,943.6	28,953.1	29,297.3	28,077.6	29,564.3	30,546.8	29,193.0	28,011.6	25,987.3	-21.1	-7.2
USPS	16,238.3	16,448.4	16,751.8	17,624.9	18,225.3	18,480.0	18,620.8	19,449.2	21,159.8	21,602.2	21,649.7	22,210.0	36.8	2.6
GSA	16,563.0	13,869.1	12,971.1	12,267.8	12,550.1	13,937.3	13,116.3	13,061.4	13,075.2	12,832.9	12,366.7	13,439.4	-18.9	8.7
DOJ	6,112.0	6,450.9	5,928.1	7,455.7	5,597.0	4,863.8	5,894.3	3,869.2	6,245.8	6,143.9	6,303.9	7,490.6	22.6	18.8
HHS	6,610.2	5,888.0	6,200.9	6,180.3	6,525.0	7,957.0	7,107.1	7,954.7	7,969.1	8,231.9	6,024.2	6,610.3	0.0	9.7
DOT	4,500.3	5,368.4	3,928.4	3,951.8	3,368.5	3,750.4	3,297.6	3,918.0	3,886.6	3,903.0	3,856.9	3,952.2	-12.2	2.5
NASA	2,948.0	3,086.4	3,108.0	3,094.0	3,246.4	3,208.1	3,080.5	3,093.9	2,962.3	3,010.8	3,206.4	3,449.6	17.0	7.6
DOI	4,762.4	3,752.5	3,664.6	3,878.5	4,073.2	4,039.4	3,886.2	3,173.4	3,974.3	3,922.1	3,596.3	2,979.1	-37.4	-17.2
USDA	2,096.3	1,900.0	2,130.7	1,826.5	1,857.7	2,363.0	2,342.4	2,151.6	2,234.8	2,164.5	2,083.1	2,261.3	7.9	8.6
DOL	2,153.0	2,179.3	2,153.2	2,230.7	2,191.1	2,137.1	2,044.1	2,063.7	2,145.8	2,158.3	2,028.8	2,153.9	0.0	6.2
TRSY	615.0	647.0	1,486.1	4,196.9	2,529.2	1,918.4	1,494.7	1,749.1	1,568.0	1,624.7	1,418.3	1,484.9	141.4	4.7
EPA	772.3	750.1	732.9	763.7	747.5	747.0	822.4	839.7	894.1	943.4	1,021.1	1,023.3	32.5	0.2
TVA	402.4	462.0	466.8	452.5	417.2	427.8	426.6	425.6	439.8	664.0	748.5	728.4	81.0	-2.7
DOC	540.3	1,214.9	1,136.3	1,294.2	1,325.1	1,376.0	1,406.9	531.0	571.9	752.9	494.9	490.1	-9.3	-1.0
ST	232.1	248.7	275.3	263.9	264.2	267.7	274.2	273.8	45.3	82.9	92.9	289.2	24.6	211.4
FEMA	96.1	151.9	157.9	171.5	192.5	215.1	198.4	204.1	188.3	172.9	172.9	172.9	80.0	0.0
HUD	116.9	117.4	119.4	123.8	139.1	140.3	129.6	123.3	117.4	113.8	106.3	115.4	-1.4	8.6
OPM	54.3	54.5	54.5	67.3	72.1	70.8	74.6	78.8	86.3	86.3	86.3	86.3	58.9	0.0
PCC	26.6	26.7	27.2	28.4	28.2	28.6	32.4	30.1	32.5	31.4	31.9	32.4	21.8	1.6
FCC	11.2	11.8	12.6	13.1	12.1	14.8	14.9	12.4	12.9	14.1	14.1	12.8	14.4	-9.7
OTHER*	218.6	290.8	362.7	391.1	437.0	412.6	230.8	235.5	151.3	144.6	930.5	1,625.4	643.6	74.7
CIVILIAN AGENCIES TOTAL														
BBTU	122,544.7	119,421.9	116,776.4	123,845.1	118,371.5	120,032.5	117,305.5	117,422.4	123,385.6	123,007.2	119,320.6	122,767.0	0.2	2.9
DOD	349,076.7	327,583.1	351,882.9	319,876.4	322,205.6	321,101.6	286,885.7	295,719.8	279,726.5	262,661.5	247,166.9	235,688.1	-32.5	-4.6
ALL AGENCIES TOTAL														
BBTU	471,621.4	447,005.0	468,659.3	443,721.5	440,577.1	441,134.1	404,191.2	413,142.2	403,112.1	385,668.7	366,487.5	358,455.2	-24.0	-2.2
MBOE	81.0	76.7	80.5	76.2	75.6	75.7	69.4	70.9	69.2	66.2	62.9	61.5		
Petajoules	497.5	471.6	494.4	468.1	464.8	465.4	426.4	435.8	425.3	406.9	386.6	378.2		

DATA AS OF 12/05/97

*Other includes for certain years the CFTC, CIA, EEOC, FTC, NARA, NSF, NRC, RRB, SSA, USIA, and FERC.

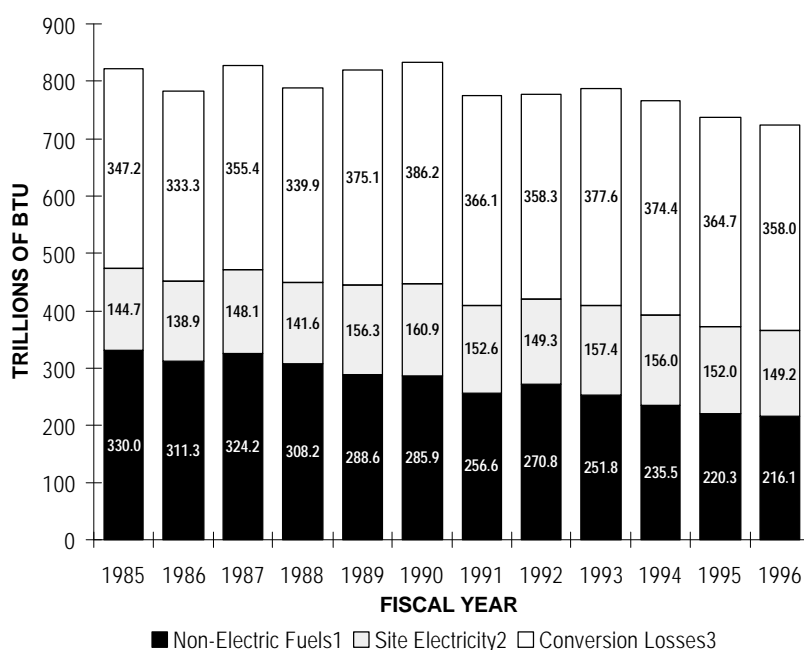
Note: FY 1996 contains estimated data for the following agencies: FEMA, FTC, and OPM. This table uses a conversion factor for electricity of 3,412 Btu per kilowatt hour. Agencies are listed in descending order of consumption for the current year. Sum of components may not equal total due to independent rounding.

Source: Federal Agency Annual Energy Management Data Reports

(49.3 trillion Btu). Coal, purchased steam, liquefied petroleum gas (LPG)/propane, and energy reported as “other” (comprised mainly of chilled water and renewable energy), account for the remaining 10.8 percent.

Figure 5 illustrates the proportion of energy consumption in buildings and facilities that is attributable to electricity for FY 1985 through FY 1996. The figure also breaks out the amount of Btu lost through the generation and transmission processes and amount of Btu delivered to the site. In FY 1996, electricity consumption, including energy used at the source of generation, accounted for approximately 70.1 percent of the total gross Btu consumed in buildings and facilities (723,296.4 billion Btu; see Table 4-A). Of this amount, approximately 29.4 percent or 149.2 trillion Btu reached the site of use. The remaining 70.6 percent, 358.0 trillion Btu, was lost during the generation and transmission processes.

FIGURE 5
Consumption of Electricity and Other Fuels
in Buildings and Facilities,
FY 1985 through FY 1996



¹Includes Fuel Oil, Natural Gas, LPG/Propane, Coal, Purchased Steam, and Other. Uses a conversion factor for steam of 1,390 Btu per pound (source conversion).

²Uses a conversion factor of 3,412 Btu per kilowatt hour. Amount of energy which reaches the site of use when generation and transmission losses are subtracted.

³Amount of energy lost through generation and transmission processes. When added to amount of energy reaching the point of use, the total equals amount of Btu consumed at the source. The source conversion factor is 11,600 Btu per kilowatt hour.

Source: Federal Agency Annual Energy Management Data Reports

Decreases in consumption relative to FY 1995 were seen in coal (29.5 percent), electricity (1.5 percent), LPG/propane (1.3 percent), and fuels reported under the category of “other” (82.8 percent). Increases from the previous year were seen in purchased steam (18.0 percent), natural gas (0.3 percent), and fuel oil (0.9 percent). Contributing to the significant variances in consumption for coal and purchased steam was the practice of agencies, such as DOE, of purchasing steam rather than generating their own in coal-fired plants.

As shown in Table 5, the consumption of petroleum-based fuels in buildings during FY 1996 decreased 53.1 percent compared to FY 1985 and increased 0.6 percent from FY 1995. Efforts by agencies to utilize natural gas as a cost-effective substitute for petroleum-based fuels in buildings as well as conservation of fuel oil and LPG/propane in buildings contributed to these reductions. Petroleum fuel consumption in buildings during FY 1996 represented only 14.5 percent of all energy consumed in Federal buildings. Of this amount, 94.6 percent is attributed to fuel oil and the remaining 5.4 percent to LPG/propane.

The energy used in buildings in FY 1996 accounted for approximately 47.2 percent of the total Federal energy bill. Tables 6-A and 6-B show that the Federal Government spent approximately \$3,631.6 million for buildings energy during the fiscal year, a decrease in constant dollars of approximately \$76.4 million from FY 1995 expenditures. The combined cost of buildings energy in FY 1996 was \$10.13 per million Btu, up 0.1 percent from the combined cost of \$10.12 reported in FY 1995 (see Appendix C).

Figure 6 illustrates energy expenditures for buildings and facilities from FY 1985 through FY

1996. In constant 1996 dollars, Federal energy costs for buildings and facilities decreased 35.0 percent from \$5,587.0 million in FY 1985 to \$3,631.6 million in FY 1996. The combined cost for buildings energy in constant dollars in FY 1996 was \$10.13 per million Btu, down 14.5 percent from \$11.80 per million Btu in FY 1985. It should be noted that inter-year comparisons between FY 1985 and FY 1996 should be viewed with caution due to fluctuations in reporting and adjustments to yearly data by agencies excluding certain energy-intensive buildings and the associated energy consumption and gross square footage from their totals as provided for in section 543(a)(2) of NECPA.

FIGURE 6
Energy Expenditures (Constant 1996 Dollars)
in Buildings and Facilities FY 1985 through FY 1996

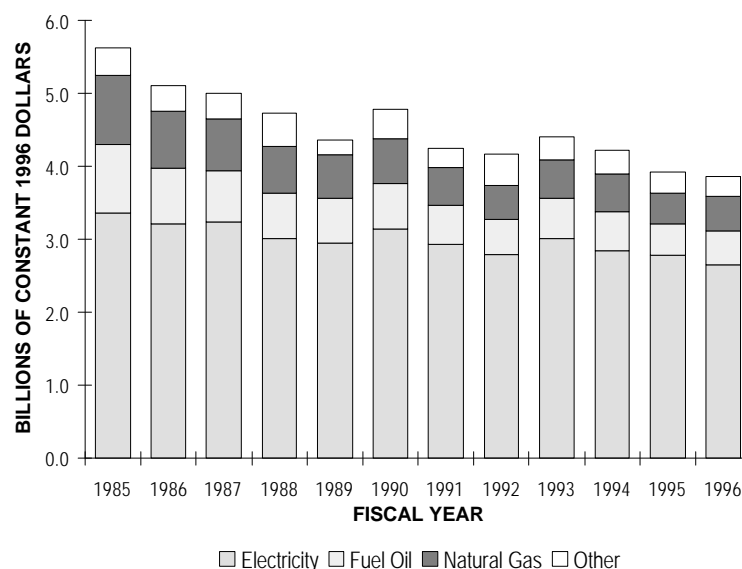


TABLE 5
PETROLEUM-BASED FUEL* CONSUMPTION IN BUILDINGS AND FACILITIES
(In Billions of Btu)

AGENCY	FY 1985	FY 1986	FY 1987	FY 1988	FY 1989	FY 1990	FY 1991	FY 1992	FY 1993	FY 1994	FY 1995	FY 1996	%CHANGE 85-96	%CHANGE 95-96
DOD	96,817.3	85,607.3	90,403.2	78,345.1	70,701.8	69,030.1	59,451.5	65,654.1	55,585.9	50,285.7	42,939.0	42,861.7	-55.7	-0.2
VA	2,176.7	2,118.5	2,261.3	2,488.2	2,328.8	2,219.3	1,404.9	1,506.0	1,533.9	1,827.4	1,292.9	2,098.2	-3.6	62.3
HHS	2,199.6	2,680.8	2,643.8	2,008.1	2,059.8	2,138.7	1,545.9	2,144.2	1,765.2	1,525.7	1,152.5	1,718.8	-21.9	49.1
DOE	1,650.8	1,315.4	1,530.2	1,563.5	1,729.0	1,900.5	2,063.7	2,042.7	1,943.5	1,924.4	1,973.5	1,554.1	-5.9	-21.2
DOI	1,591.6	1,430.7	1,272.1	1,364.7	1,376.7	1,273.9	1,141.1	919.1	1,181.9	1,560.6	1,574.3	1,177.7	-26.0	-25.2
DOT	2,376.9	3,564.0	2,107.2	2,100.0	1,534.8	1,524.1	1,308.4	1,426.0	854.0	1,001.6	911.7	709.2	-70.2	-22.2
USPS	1,673.2	1,591.6	1,556.3	1,602.6	1,555.7	1,502.2	1,219.4	1,195.8	988.8	983.7	813.9	595.2	-64.4	-26.9
GSA	991.3	667.8	530.3	561.8	544.0	668.1	443.1	418.2	359.4	379.8	199.0	242.3	-75.6	21.7
DOJ	381.7	363.4	467.3	970.3	310.8	371.6	503.7	383.8	250.8	234.8	182.8	234.3	-38.6	28.2
DOL	437.8	414.5	427.0	387.3	394.5	331.2	258.3	263.6	276.1	277.5	210.8	220.6	-49.6	4.7
TRSY	22.5	25.4	172.9	294.2	319.3	281.3	127.7	84.2	190.5	160.8	116.6	116.2	417.2	-0.3
NASA	230.2	233.2	262.0	253.1	291.2	277.8	161.6	217.6	134.5	139.6	82.3	110.9	-51.8	34.7
CIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	49.6	87.9	0.0	77.2
USDA	414.2	260.7	191.0	206.4	229.1	260.0	291.3	242.9	255.6	236.3	244.1	242.5	-41.4	-0.7
EPA	16.8	15.8	14.6	12.4	14.3	5.9	6.4	17.6	13.9	26.8	43.4	51.8	208.8	19.2
FEMA	56.7	62.8	73.2	77.0	77.8	72.3	59.1	66.9	67.6	49.1	49.1	49.1	-13.5	0.0
DOC	130.3	95.5	78.9	85.1	36.8	77.6	13.1	9.8	23.8	52.4	10.8	33.4	-74.4	210.3
ST	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.8	0.0	0.0
SSA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8.2	0.0	0.0
TVA	4.2	2.9	1.6	3.0	1.2	3.2	0.1	1.3	2.7	3.5	3.9	4.1	-3.7	5.0
FCC	1.7	1.6	1.4	1.7	1.5	1.9	1.0	1.3	1.3	1.3	1.3	1.7	0.8	34.0
USIA	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0
EEOC	0.0	0.0	0.0	0.0	2.3	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL	111,173.6	100,452.0	103,994.4	92,324.6	83,509.6	81,941.6	70,000.2	76,595.5	65,429.4	60,671.0	51,851.4	52,139.7	-53.1	0.6

DATA AS OF 12/05/97

*Petroleum-based fuels include fuel oil and LPG/propane.

Note: FY 1996 contains estimated data for the following agencies: FEMA, FTC, and OPM.

Sum of components may not equal total due to independent rounding.

Source: Federal Agency Annual Energy Management Data Reports

TABLE 6-A
DEFENSE AND CIVILIAN FEDERAL COSTS FOR BUILDINGS ENERGY IN FY 1996
(In Millions of Dollars)

	ELECTRICITY	FUEL OIL	NATURAL GAS	LPG/ PROPANE	COAL	PURCHASED STEAM	OTHER	TOTAL
DEFENSE	1,539.658	191.503	288.987	15.696	33.168	152.180	2.384	2,223.576
CIVILIAN	1,115.547	42.341	174.006	5.799	8.293	59.323	2.707	1,408.017
TOTAL	2,655.205	233.844	462.993	21.495	41.461	211.503	5.091	3,631.593

AVERAGE COST PER UNIT, BASED ON REPORTS FROM AGENCIES

ELECTRICITY	=	60.72 /	MWH
FUEL OIL	=	0.66 /	GALLON
NATURAL GAS	=	3.93 /	THOUSAND CUBIC FEET
LPG/PROPANE	=	0.73 /	GALLON
COAL	=	56.05 /	SHORT TON
PURCHASED STEAM	=	12.14 /	MILLION BTU
OTHER	=	29.31 /	MILLION BTU

DATA AS OF 12/05/97

Note: Contains estimated data for the following agencies: FEMA, FTC, and OPM.
Sum of components may not equal total due to independent rounding.

Source: Federal Agency Annual Energy Management Data Reports.

TABLE 6-B
CONSUMPTION AND COSTS OF FEDERAL BUILDINGS ENERGY
BY FUEL TYPE IN FY 1996, FY 1995, AND FY 1985
(Constant 1996 Dollars)

ENERGY TYPE	BILLIONS OF BTU	COST PER MMBTU	COST (IN MILLIONS OF DOLLARS)
FY 1996			
ELECTRICITY	149,200.1	17.7963	2,655.205
FUEL OIL	49,344.6	4.7390	233.844
NATURAL GAS	121,335.3	3.8158	462.993
LPG/PROPANE	2,795.1	7.6902	21.495
COAL	18,180.9	2.2805	41.461
PURCHASED STEAM	17,425.4	12.1376	211.503
OTHER	173.7	29.3119	5.091
TOTAL	358,455.2		3,631.593
COMBINED COST PER MMBTU = \$10.131			
FY 1995			
ELECTRICITY	151,547.7	18.2674	2,775.812
FUEL OIL	48,928.2	4.4246	216.886
NATURAL GAS	120,990.3	3.5603	431.177
LPG/PROPANE	2,833.2	6.8476	19.401
COAL	25,773.6	2.6201	67.528
PURCHASED STEAM	14,769.3	13.2004	195.248
OTHER	1,011.1	1.9093	1.931
TOTAL	365,853.5		3,707.983
COMBINED COST PER MMBTU = \$10.117			
FY 1985			
ELECTRICITY	144,463.6	23.2856	3,369.291
FUEL OIL	107,575.3	8.3541	898.811
NATURAL GAS	144,809.8	6.4541	935.522
LPG/PROPANE	3,604.2	9.6775	34.880
COAL	58,069.5	3.2827	190.624
PURCHASED STEAM	7,998.3	15.7551	126.143
OTHER	4,709.9	6.7392	31.741
TOTAL	471,230.6		5,587.011
COMBINED COST PER MMBTU = \$11.846			
DATA AS OF 12/05/97			

Note: FY 1996 contains estimated data for the following agencies: FEMA, FTC, and OPM.

FY 1995 contains estimated data for the following agencies: FCC, FEMA, FTC, and OPM.

This table uses a conversion factor for electricity of 3,412 Btu per kilowatt hour. Sum of components may not equal total due to independent rounding.

Source: Federal Agency Annual Energy Management Data Reports

Electricity costs of \$2,655.2 million represent approximately 73.1 percent of the total expenditures of \$3,631.6 million for buildings energy in FY 1996. Natural gas costs account for approximately 12.7 percent of the total, expenditures for fuel oil account for 6.4 percent, with the remaining 7.8 percent attributable to expenditures for LPG/propane, coal, purchased steam, and “other.”

In FY 1996, the cost of all energy used in Federal buildings was \$1.20 per gross square foot. Of the \$1.20 spent per square foot Government-wide, \$0.88 was spent for electricity, \$0.15 was spent for natural gas, \$0.08 was spent for fuel oil, and the remaining \$0.09 was spent for purchased steam, coal, LPG/propane, and other fuels.

B. Progress Toward the Mandated Goals for Buildings and Facilities

Overall, the Federal Government reduced its net energy consumption in buildings and facilities by 15.2 percent in FY 1996 compared to FY 1985 when measured in terms of British Thermal Units consumed per gross square foot (Btu/GSF) of floor area. Federal Government progress toward the 10, 20, and 30 percent energy reduction goals of NECPA and Executive Order 12902 is illustrated in Figure 7.

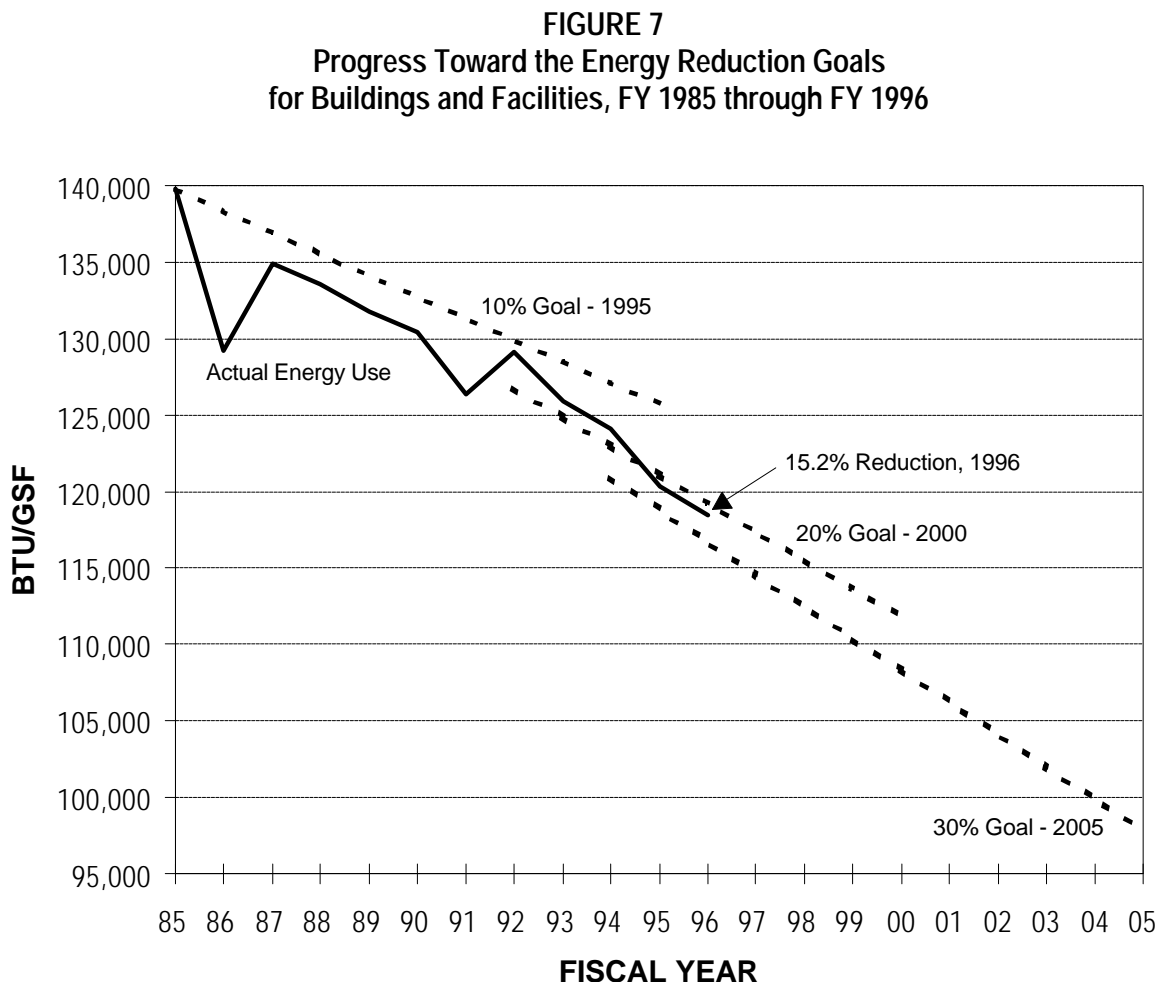


Table 7-A shows the FY 1996 performance of the individual agencies in net Btu/GSF compared to FY 1985. Net Btu reflects the amount of energy delivered to the point of use and is used to measure agency performance toward the mandated goals.

Table 7-B shows the performance of the agencies measured in terms of gross Btu/GSF. Gross Btu represents the average amount of energy required at the point of generation (source energy) rather than the actual Btu delivered to the site. Gross Btu includes energy resources used to generate, process, and transport electricity and steam. Measured in terms of source energy, the Federal Government shows a reduction of 1.9 percent in FY 1996 compared to FY 1985. This large difference from the net Btu/GSF reduction of 15.2 percent reflects the significant declines in direct use of fossil fuels and the offsetting increases in electricity consumption.

Contributing to the overall reduction of 15.2 percent in net Btu/GSF were the percentage reductions greater than 10 percent made by the following agencies: the Departments of Agriculture, Defense, Commerce, Energy, Justice, Veterans Affairs, the Interior, Transportation, and the General Services Administration, National Aeronautics and Space Administration, Environmental Protection Agency, and the Tennessee Valley Authority.

These agencies used a variety of strategies to reduce their energy consumption. Operations and maintenance (O&M) procedures continued to be emphasized as a major component in the effort to achieve the energy reduction goals. Improvements in energy efficiency were achieved through improved energy systems operations and both preventive maintenance and improved maintenance. O&M funding, used for the replacement of boilers, HVAC equipment, windows, and lighting systems, continued to benefit energy conservation.

In FY 1996, the implementation of many no-cost and low-cost energy conservation measures was continued, such as reducing lighting levels, lowering hot water temperatures, turning off unused equipment, and installing energy-efficient windows, insulation, weather stripping, and set-back thermometers.

Numerous energy-efficient building retrofits and energy conservation projects were undertaken to supplement the no-cost, low-cost measures. These initiatives can be categorized by lighting system replacement, HVAC equipment modernization, building envelope improvements, and other miscellaneous projects, such as installation of energy management control systems. Utility-sponsored demand side management programs were often pursued as supplemental sources of funding, as well as energy savings performance contract initiatives.

Other activities include energy awareness programs featuring energy awareness seminars, the identification of no-cost or low-cost measures, the designation of building energy monitors, publication of materials promoting energy efficiency, the procurement of energy-efficient goods and products, increased maintenance training, and increased engineering assistance.

A number of agencies began submitting energy data to DOE starting in FY 1989 in compliance with NECPA as amended by the Federal Energy Management Improvement Act of 1988 (Pub. L. 100-615). Among these agencies are the Department of State, the Office of Personnel Management, and the Federal Energy Regulatory Commission. These three agencies submitted historical energy data back to FY 1985.

TABLE 7-A
FEDERAL BUILDINGS AND FACILITIES NET ENERGY USE
PER GROSS SQUARE FOOT, FY 1985 AND FY 1996

	FISCAL YEAR 1985			FISCAL YEAR 1996			%CHANGE 1985-1996
	GSF (Thousands)	BTU (Billions)	BTU/GSF	GSF (Thousands)	BTU (Billions)	BTU/GSF	
VA	123,650.0	24,552.0	198,560	149,730.0	26,172.3	174,796	-12.0
DOE	73,415.8	32,923.2	448,449	87,655.5	25,987.3	296,471	-33.9
USPS	189,400.0	16,238.3	85,736	278,000.0	22,210.0	79,892	-6.8
GSA	196,341.4	16,563.0	84,358	177,600.0	13,439.4	75,672	-10.3
DOJ	20,768.8	6,112.0	294,289	38,819.0	7,490.6	192,963	-34.4
HHS	22,611.3	6,610.2	292,340	23,570.0	6,610.3	280,454	-4.1
DOT	32,007.8	4,500.3	140,599	34,302.4	3,952.2	115,217	-18.1
NASA	11,509.0	2,948.0	256,149	17,294.0	3,449.6	199,465	-22.1
DOI ¹	54,154.4	4,762.4	87,940	50,847.3	2,979.1	58,589	-33.4
USDA	28,980.5	2,096.3	72,336	40,208.4	2,261.3	56,239	-22.3
DOL	18,268.3	2,153.0	117,852	18,155.2	2,153.9	118,636	0.7
TRSY	5,776.9	615.0	106,463	11,260.8	1,484.9	131,866	23.9
EPA	1,931.2	772.3	399,923	2,850.1	1,023.3	359,050	-10.2
TVA	4,886.6	402.4	82,357	10,160.5	728.4	71,693	-12.9
DOC	4,522.6	540.3	119,476	5,774.2	490.1	84,870	-29.0
ST	2,597.0	232.1	89,390	2,896.7	289.2	99,828	11.7
FEMA	606.0	96.1	158,579	1,411.0	172.9	122,561	-22.7
HUD	1,432.0	116.9	81,668	1,432.0	115.4	80,563	-1.4
OPM	853.9	54.3	63,609	938.4	86.3	91,947	44.5
PCC	492.5	26.6	54,079	500.9	32.4	64,779	19.8
FCC	121.0	11.2	92,182	124.8	12.8	102,204	10.9
OTHER*	1,098.6	218.6	198,982	11,833.8	1,625.4	137,354	-31.0
CIVILIAN AGENCIES TOTAL							
BBTU	795,425.6	122,544.7	154,062	965,365.0	122,767.0	127,172	-17.5
DOD	2,578,984.0	349,076.7	135,354	2,060,462.0	235,688.1	114,386	-15.5
TOTAL	3,374,409.6	471,621.4	139,764	3,025,827.0	358,455.2	118,465	-15.2

DATA AS OF 12/05/97

*Other includes the Federal Trade Commission, National Archives and Records Administration, National Science Foundation, Nuclear Regulatory Commission, Railroad Retirement Board, the U.S. Information Agency, and the Federal Energy Regulatory Commission.

¹The Interior Department's consumption and GSF data for FY 1996 include estimates for the National Park Service. The Park Service estimated approximately 76 percent of its consumption based on available actual data and known total GSF. The Park Service was unable to provide data for all buildings and facilities due to reorganizations and monetary and personnel cutbacks.

Note: FY 1996 contains estimated data for the following agencies: FEMA, FTC, and OPM.
This table uses a conversion factor for electricity of 3,412 Btu per kilowatt hour.
Sum of components may not equal total due to independent rounding.

Source: Federal Agency Annual Energy Management Data Reports

TABLE 7-B
FEDERAL BUILDINGS AND FACILITIES GROSS ENERGY USE
PER GROSS SQUARE FOOT, FY 1985 AND FY 1996

	FISCAL YEAR 1985			FISCAL YEAR 1996			%CHANGE 1985-1996
	GSF (Thousands)	BTU (Billions)	BTU/GSF	GSF (Thousands)	BTU (Billions)	BTU/GSF	
USPS	189,400.0	39,441.0	208,242	278,000.0	58,757.3	211,357	1.5
DOE	73,415.8	57,430.1	782,258	87,655.5	53,930.0	615,250	-21.3
VA	123,650.0	42,333.7	342,367	149,730.0	48,062.3	320,993	-6.2
GSA	196,341.4	41,207.0	209,874	177,600.0	34,286.0	193,052	-8.0
DOJ	20,768.8	8,962.7	431,545	38,819.0	14,391.8	370,740	-14.1
HHS	22,611.3	12,605.4	557,484	23,570.0	12,623.5	535,573	-3.9
DOT	32,007.8	8,298.7	259,270	34,302.4	9,097.4	265,210	2.3
NASA	11,509.0	6,373.5	553,783	17,294.0	8,571.6	495,642	-10.5
DOI ¹	54,154.4	8,432.5	155,713	50,847.3	6,177.5	121,492	-22.0
USDA	28,980.5	4,347.2	150,004	40,208.4	5,280.2	131,322	-12.5
DOL	18,268.3	3,687.8	201,871	18,155.2	4,043.4	222,712	10.3
TRSY	5,776.9	1,451.0	251,178	11,260.8	3,607.0	320,315	27.5
TVA	4,886.6	1,321.0	270,333	10,160.5	2,387.9	235,014	-13.1
EPA	1,931.2	1,618.3	838,001	2,850.1	2,096.3	735,524	-12.2
DOC	4,522.6	1,189.1	262,925	5,774.2	1,313.7	227,520	-13.5
ST	2,597.0	689.2	265,377	2,896.7	780.5	269,460	1.5
FEMA	606.0	190.5	314,426	1,411.0	410.3	290,766	-7.5
HUD	1,432.0	349.3	243,951	1,432.0	332.9	232,492	-4.7
OPM	853.9	168.1	196,822	938.4	237.1	252,704	28.4
PCC	492.5	90.5	183,854	500.9	110.3	220,238	19.8
FCC	121.0	29.5	244,132	124.8	31.7	253,838	4.0
OTHER*	1,098.6	588.9	536,037	11,833.8	4,379.2	370,058	-31.0
CIVILIAN AGENCIES TOTAL							
BBTU	795,425.6	240,805.2	302,738	965,365.0	270,907.9	280,627	-7.3
DOD	2,578,984.0	581,170.2	225,349	2,060,462.0	452,388.4	219,557	-2.6
TOTAL	3,374,409.6	821,975.4	243,591	3,025,827.0	723,296.4	239,041	-1.9

DATA AS OF 12/05/97

*Other includes the Federal Trade Commission, National Archives and Records Administration, National Science Foundation, Nuclear Regulatory Commission, Railroad Retirement Board, the U.S. Information Agency, and the Federal Energy Regulatory Commission.

¹The Interior Department's consumption and GSF data for FY 1996 include estimates for the National Park Service. The Park Service estimated approximately 76 percent of its consumption based on available actual data and known total GSF. The Park Service was unable to provide data for all buildings and facilities due to reorganizations and monetary and personnel cutbacks.

Note: FY 1996 contains estimated data for the following agencies: FEMA, FTC, and OPM.
This table uses a conversion factor for electricity of 11,600 Btu per kilowatt hour and 1,390 Btu per pound of steam.
Sum of components may not equal total due to independent rounding.

Source: Federal Agency Annual Energy Management Data Reports

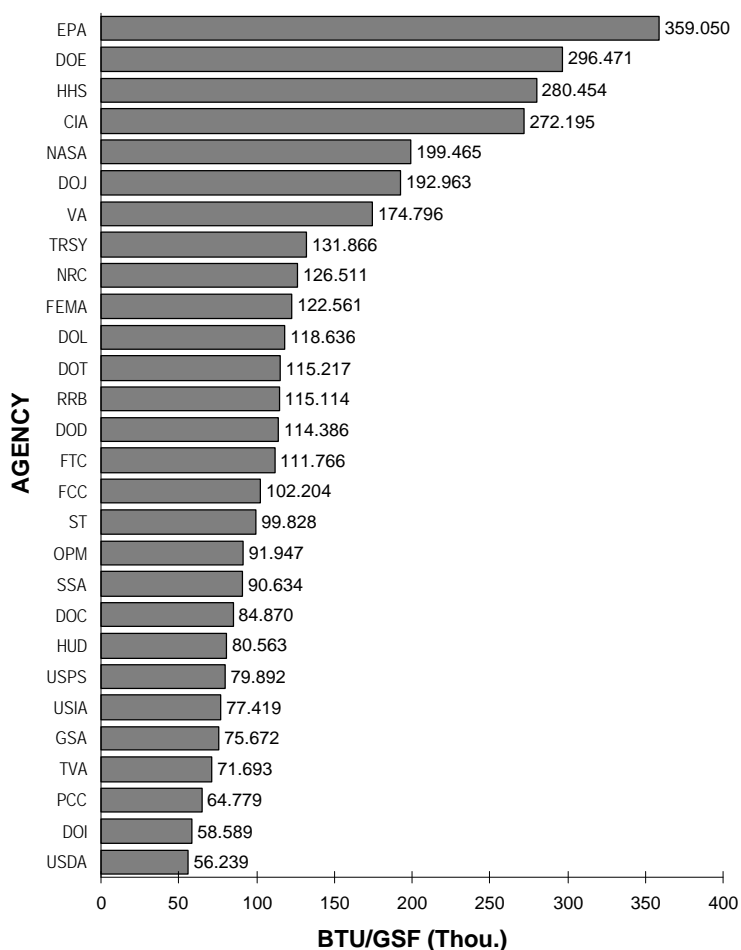
For FY 1990 and forward, Federal Energy Regulatory Commission energy consumption is reported as part of DOE and is therefore grouped under the category of “Other.” Other agencies grouped under the category of “Other” in the tables had no buildings data to report for FY 1985. These agencies include the Federal Trade Commission, the National Archives and Records Administration, the Nuclear Regulatory Commission, the Railroad Retirement Board, and the U.S. Information Agency. The National Science Foundation is also grouped under this category due to inconsistencies in its reporting.

In FY 1996, GSA continued to delegate building management authority to agencies that occupy buildings owned and operated by GSA. As a result, several agencies reported increased gross square footage and energy consumption relative to FY 1985, while GSA reported decreases in these categories during the same period. The GSA delegation accounts for the significant inter-year changes in energy consumption reported by various individual agencies. Two agencies, the Department of Health and Human Services and the Department of Commerce, adjusted their baseline year consumption and GSF figures during FY 1988 to reflect GSA delegations. DOC added the Jeffersonville Federal Center to its data reports, which greatly increased its gross square footage. In addition, three Commerce Bureaus, the Bureau of Economic Affairs, the National Technical Information Service, and the Patent and Trademark Office, all became eligible for reporting in FY 1989 as a result of leasing delegation.

The Treasury Department’s large increase in buildings energy consumption since FY 1985, is a result of the addition of the Internal Revenue Service delegated buildings to the Department’s building inventory. Also contributing to the increase were the addition, in FY 1989, of the Office of Thrift Supervision’s square footage and the GSA delegation of building management authority for the Financial Management Service. The energy consumption and square footage for these delegated buildings were included in GSA’s FY 1985 reports.

Figure 8 illustrates the range of energy intensity in agency buildings measured in terms of Btu/GSF. DOE’s high rate of Btu/GSF is the result of unmetered process energy reported under the buildings

FIGURE 8
Range of Energy Intensity (Btu/GSF) in Buildings and Facilities by Agency in FY 1996



category. DOE estimates that approximately 80 percent of its building energy is consumed in unmetered process and production operations, with about 20 percent used for HVAC, lighting, and building services. If more than 80 percent of a facility's metered energy is dedicated to process operations, then the entire facility's energy is excluded from the buildings category, according to how DOE defines its buildings and facilities. The Interior Department's relatively low Btu/GSF results from the lack of energy intensive activities (i.e., laboratories, hospitals, etc.) in space under its control. The wide range of rates of Btu/GSF among different agencies is a result of the varying missions of the agencies as well as their varying criteria for excluding energy intensive facilities.

C. Federal Building Energy Performance Standards

Federal agencies are subject to the provisions of 10 CFR part 435, subpart A which set forth interim building energy performance standards for new Federal buildings. These standards were issued under the Energy Conservation Standards in New Buildings Act of 1976, as amended, 42 U.S.C. 6831 *et seq.* On August 6, 1996, the Department of Energy issued a proposed rule in the *Federal Register*, 61 FR 40882, to revise the 1989 interim rule, 10 CFR part 435, which established energy efficiency voluntary performance standards for design of new Federal commercial and multi-family high rise residential buildings. Standards for new Federal buildings are issued under the Energy Conservation Standards in New Buildings Act of 1976, as amended, 42 U.S.C. 6831 *et seq.* and under Title V, subtitle H, of the Energy Security Act, 42 U.S.C. § 8286 and 8286a.

EPACT mandates that new Federal buildings must contain energy saving and renewable energy specifications that meet or exceed the energy saving and renewable energy specifications of the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)/ Illuminating Engineering Society of North America (IES) Standard 90.1-1989 and the Council of American Building Officials Model Energy Codes (MEC) 1992.

Furthermore, Executive Order 12902, which was designed to assist agencies in meeting or exceeding the Federal energy and water efficiency provisions contained in EPACT, requires each agency involved in the construction of a new facility that will be either owned by or leased to the Government to:

- (1) design and construct such facility to minimize the life-cycle cost of the facility by utilizing energy efficiency, water conservation, or solar or other renewable energy technologies;
- (2) ensure that the design and construction of facilities meet or exceed the energy performance standards applicable to Federal residential or commercial buildings as set forth in 10 CFR 435, local building standards, or a Btu-per-gross-square-foot ceiling as determined by the Task Force within 120 days of the date of this order, whichever will result in a lower life-cycle cost over the life of the facility;
- (3) establish and implement, within 270 days of the date of this order, a facility commissioning program that will ensure that the construction of such facilities meets the requirements outlined in this section before the facility is accepted into the Federal facility inventory; and

- (4) utilize passive solar design and adopt active solar technologies where they are cost-effective.

The Department of Energy has endeavored to fulfill these requirements by developing common energy conservation standards for all new Federal buildings and by issuing life-cycle costing procedures for use by Federal agencies in the assessment of energy conserving investments for buildings.

The proposed rule, *Energy Code for New Federal Commercial and Multi-Family High Rise Residential Buildings*, revises the interim Federal standards to conform generally with the codified version of ASHRAE Standard 90.1-1989 and incorporates changes in the areas of lighting, mechanical ventilation, motors, building envelope and fenestration rating procedures, and test procedures for heating and cooling equipment. Since Standard 90.1-1989 is written as a standard of professional practice, it cannot be directly adopted as a building code. DOE will publish the final rule after resolving the issues raised during the public comment process and during the public hearing held on September 6, 1996. The final version of the Federal commercial code is expected to be published in FY 1997.

A separate proposed rule for new Federal residential buildings was issued by the Department of Energy in the *Federal Register* in May 1997. The proposed rule, *Energy Code for New Federal Residential Buildings* uses the Model Energy Code (MEC) format and contain performance standards from the current Federal residential standard, the MEC, and the codified version of ASHRAE Standard 90.2-1993 that are economically justified and technologically feasible.

DOE has also worked closely with HUD in coordinating the technical factors and data used to develop HUD's Manufactured Housing Standards and has committed to work closely with all Federal agencies to coordinate and upgrade the standards applied by these agencies to non-Federal buildings.

In response to the Executive Order 12902 requirement for Federal agencies to establish and implement a facility commissioning program, DOE formed the New Space Working Group under the Interagency Energy Management Task Force. The Working Group, in conjunction with GSA and other Federal agencies drafted a *Building Commissioning Guide* which has been distributed to agencies for comment and will be posted on the Federal Energy Management Program's Home Page at <http://www.eren.doe.gov/femp> for use during the review process.

DOE is concurrently working on a model commissioning plan, based on a GSA plan for a Federal courthouse in Portland, Oregon. This model will be more detailed than the *Building Commissioning Guide* and will include forms, model plans, training, and acceptance procedures for the building.